

Target Physics:

Indirect drive cylinders: Recent Nova experiments have significantly improved our understanding of hydrodynamic instability growth from surface perturbations placed on indirectly driven cylindrical targets. Typically these cylinders are constructed of a low-Z pusher with an embedded (chlorine) marker layer which implodes on a very low density foam core. Time resolved x ray radiographs are used to record perturbation growth inside the cylindrical implosion. Recent analysis has led us to conclude that much of the observed radiographic contrast came from densification of the low-Z pusher during the radial implosion, and not from the chlorinated marker layer as previously believed. This conclusion has since been supported by experiments using cylinders with no marker layer and will allow considerable simplification of future cylindrical target fabrication. In these same experiments we have observed the evolution of the Rayleigh-Taylor (RT) instability in cylinders with a high amplitude ($5\text{ }\mu\text{m}$) $m = 10$ initial sinusoidal surface perturbation. These cylinders developed very non-linear perturbations (amplitude/wavelength > 1) with apparently rich harmonic content. Several interesting features of this strongly nonlinear experiment are under study. This experiment is proving to be an excellent benchmark for the Lasnex and Rage codes.

Indirect drive planar targets: Another round of hydrodynamic experiments was conducted using planar targets with large sinusoidal front surface perturbations. Such perturbations could represent a gap or bump, for example. The ablation front and the shock front profiles were radiographed as a function of time from the start of the drive pulse until after the shock had reflected off the back surface of the target. Although shock profiles were in qualitative agreement with predictions we also observed a rarefaction which caused a strongly spiked feature to propagate in the forward (drive) direction while we did not observe any jetting of material from the breakout of the shock. Detailed quantitative analysis will be required.

LPI: On Nova, using spatially unsmoothed laser beams, we have obtained far-field (target plane) images (100 ps , $25\text{ }\mu\text{m}$ resolution) of SBS light from the plasma near the wall in a gold hohlraum with the LANL FABSI optical backscatter imaging diagnostic. The images were observed to have a clumpy structure, in contrast with those taken with random phase plate beam smoothing. In addition, the image spatial position indicates no beam deflection, consistent with predictions for vacuum hohlraums.

Fast ignitor: We have completed simulations of the fast ignitor concept for the interaction of laser beams with matter at intensities of 10^{19} W/cm^2 and higher using the Anthem code. The pondermotive force pushes a channel into the material which focuses the hot electrons in the desired forward direction towards the center of the laser spot. At 10^{21} W/cm^2 12 MeV electrons and magnetic fields greater than 250 megagauss are produced. These fields inhibit return currents. In the process very fast ions are emitted back toward the laser, reducing the efficiency of the electron production. Further computational work needs to include relativistic effects to more accurately model electron transport at the high densities (10^{26} e/cm^3 and 300 g/cm^3) relevant to the fast ignitor concept. We have submitted a paper to *Physical Review Letters* detailing our research in this area.

Fabrication:

A series of large thin wall glass targets were filled with DT for a series of implosion experiments at OMEGA. Sets of targets were filled to pressures of 10, 20, and 40 atm. The targets, which were in the range 1200-1300 micron diameter with approximately 4 micron wall, were shot at OMEGA the week of September 8. Due to their relatively thin wall and large size, these targets had to be filled at a slow rate to avoid crushing the targets. All of the targets survived the filling, with the exception of one target in the 40 atm run, which is consistent with statistical predictions of the target survival probabilities.